



**CALIFORNIA STATE SCIENCE FAIR
2014 PROJECT SUMMARY**

Name(s) Gurveer Singh	Project Number J1824
Project Title The Analysis of Pollution Using Underwater Acoustic Networks	
<p style="text-align: center;">Abstract</p> <p>Objectives/Goals The primary objective of this project is to determine whether underwater acoustic networks, or UAN's, can be used as a system to monitor pollution in relatively large bodies of water. Also, its purpose was to expand upon initial studies by various companies and develop a system which uses acoustic technology to identify the amounts of contaminants in a solution. This system's capabilities to analyze pollution were tested through the addition of sodium chloride and refined oil.</p> <p>Methods/Materials An underwater acoustic network was created by initially designing the signal generator and signal receiver of the apparatus. The signal generator was created by purchasing an oscilloscope (72 MHz analog bandwidth) and modifying it so that it could produce the signal using a smartphone's transducers. I connected this to a clear PVC pipe (5 cm x 5 m), while creating the signal receiver by modifying a decibel meter so that it is waterproof. Once the apparatus was finished, sodium chloride was added to distilled water to create a solution which would be placed in the PVC pipe. Also, oil is added to distilled water to create the second part of the experiment. It is mixed by a magnetic mixture to ensure that it is homogeneous.</p> <p>Results After the experiment was completed, the addition of sodium chloride increased the decibel level by 2 dB with an increase of 5 g, incrementally. With the addition of 20 g of sodium chloride in 100 ml, the decibel level increase to 98.1 dB from 90 dB. When I added 25-100 ml of oil to 1 L of distilled water, the decibel levels decreased by an average of 4.3 dB.</p> <p>Conclusions/Discussion The addition of sodium chloride increased the decibel levels, while the addition of oil decreased the decibel levels. The first experiment agreed with my hypothesis, however the second experiment dealing with oil did not. Interesting observations were made during the testing of sodium chloride. An interesting observation is that the addition of salt could have allowed for the creation of density-based thermoclines. These observations may act as the key understanding for the phenomena that occur with underwater acoustic networks.</p>	
Summary Statement A small-scale underwater acoustic network was built to test and record its capabilities of analysis for contaminants in a water supply.	
Help Received I would like to thank my instructor, Mr. Briner, for helping me purchase much of the scientific equipment.	